

GREENHOUSE AND NURSERY
TRAINING FOR THE BLIND

IN A

VOCATIONAL REHABILITATION
SETTING

AT THE

GEORGIA ACADEMY FOR THE BLIND

Macon, Georgia

BY

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Office of Vocational Rehabilitation
U.S. Department of Health, Education, and Welfare

and

Vocational Rehabilitation Division
Georgia State Department of Education
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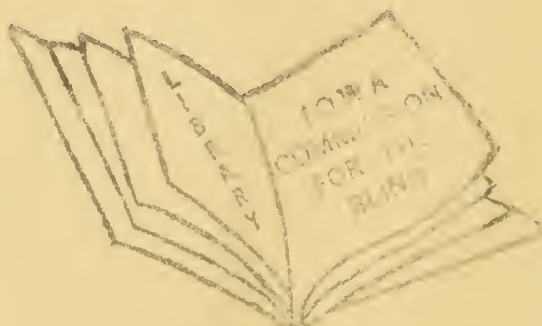
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GREENHOUSE AND NURSERY TRAINING FOR THE BLIND

**IN A
REHABILITATION SETTING**

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Vocational Rehabilitation Division
Dr. A. P. Jarrell, Director

W. B. Gaines, Supervisor
Services for the Blind

Georgia Academy for the Blind
F. G. Nelms, Superintendent
Project Director

PREFACE

Although the primary purpose of this project was to find another source of profitable employment for blind and industrially blind persons, it was considered equally important that the new enterprise also should give trainees peace of mind, the satisfaction of accomplishment, and a feeling of security. Work with horticultural plants in greenhouses and gardens has been found to have an important place in the therapy of convalescent and mental patients. The results of the work reported herein and observations of the "graduates" of this program indicate that the therapeutic effects of horticultural work might be equally as important as the income which might be derived from it.

This project was designed as a research project. The "follow-through" on placing the trainees in actual employment and the observations on the trainees on the job has given it demonstrational value and made it a complete pioneer operation.

This bulletin presents both the results of the research and the observations of the trainees on the job. It is intended primarily as a guide for other vocational rehabilitation groups who want to broaden the opportunities for blind persons. Such groups should consider that horticultural work for blind persons offers them three things; namely, opportunity for employment, mental and physical well-being, and a sense of security derived from the positive orientation which can be obtained in a greenhouse or small nursery situation.

In conclusion, I would like to express my own pleasure and satisfaction in having shared in a small way in this fine project.

Francis E. Johnstone, Jr., Chairman
The Division of Horticulture
The University of Georgia
Athens, Georgia

April, 1960

FOREWORD

For years the shortage of job opportunities for blind and visually handicapped persons in rural communities has been a major problem confronting Vocational Rehabilitation workers.

In states having a substantial proportion of population in rural communities, most of the visually handicapped applicants for rehabilitation services have farm backgrounds. Their only work experience, if any, has been in agriculture and related occupations. They are "rooted in the soil." Moreover, only a few of them have any salable industrial skills, or formal education beyond the seventh grade.

We believed that many of these men and women, despite their handicaps, could learn the fundamentals of horticulture and greenhouse operations, and acquire skills to fill specific jobs in commercial enterprises, or self-employment.

Under such circumstances, we welcomed the opportunity to sponsor this project. The results of the experiment, we feel, justify the continuation of this type of training program.

The site of the project—The Georgia Academy for the Blind at Macon—is a state institution founded more than a century ago. It is operated by the Stat Board of Education through the State Department of Education and the Vocational Rehabilitation Division.

The modern greenhouse was built with a view to its utilization as a project facility. It also has provided opportunities for advanced students to gain new learning experiences, test their interests and aptitudes, even though they were not enrolled as trainees in the project.

The Academy offers the same basic academic courses found in regular public schools, from elementary grades through high school, with special emphasis upon music and vocational training. Teaching aids designed especially for the blind are used.

Upon graduation, pupils may be provided with advanced academic or technical training through Vocational Rehabilitation services.

A. P. Jarrell, State Director
Vocational Rehabilitation Services

ACKNOWLEDGMENTS

I wish to express my appreciation to the many persons participating in the Greenhouse and Nursery project at the Georgia Academy for the Blind. To many, whom space does not permit being named here, my appreciation is also expressed for advice, ideas, and gems of encouragement.

My gratitude goes especially to the project director, Mr. F. G. Nelms, Superintendent of the Georgia Academy for the Blind, for his untiring efforts in providing facilities, helpful advice, moral support and encouragement; to Dr. A. P. Jarrell, Director of Vocational Rehabilitation Services, State Department of Education, for his superb cooperation and assistance in the organization and augmentation of the project; to Dr. Francis F. Johnstone, Jr., Chairman of the Division of Horticulture, University of Georgia, and Dr. Dale V. Sweet, Assistant Professor of Horticulture, University of Georgia, for the many hours spent in advising and consulting with the personnel of the project; to Mr. W. B. Gaines, Supervisor of Services for the Blind, Vocational Rehabilitation, and Mr. S. Hugh Bryan, Agricultural Specialist for the Blind, Vocational Rehabilitation, for their fine cooperation and many instructive hours spent with us "at the project site"; to Mr. J. Hiram Chappell, Rural Specialist of the Office of Vocational Rehabilitation, Washington, D. C., for valuable assistance in organizing the project; and to the many persons in the Office of Vocational Rehabilitation, both national and regional, without whose help and cooperation such undertaking would have been impossible.

The help of the many greenhouse operators and nurserymen who have contributed much to this project, is also gratefully acknowledged. Their generous and continuous guidance throughout the four years of research and evaluation was most helpful. Finally, to the Counselors for the blind, without whom the trainees for the project would not have been available, my sincere appreciation is expressed.

Earl N. Hester

Horticulturist

Georgia Academy for the Blind

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CHAPTER I —INTRODUCTION

A. General Purpose and Justification

The purpose of the Project at the Georgia Academy for the Blind was to expand employment opportunities for the blind by determining and demonstrating the greenhouse and nursery jobs that blind persons can be trained to do. This report makes available to interested persons and agencies the progress and results of the four years of work on the project.

According to the most recent information available from the U. S. Department of Agriculture, 13.5 % of the total population of the United States, live on farms. Reliable sources estimate the number of blind persons in the United States at 350,000. If we assume the blind population is distributed evenly over the country, it may be estimated that there are 47,250 blind persons on farms.

Since experience in the field of rehabilitation has shown about 25 % of those disabled by blindness can be restored to gainful employment, it may be concluded that approximately 10,000 of the 47,000 blind farm residents could be rehabilitated if adequate services and facilities were available to them. There is, of course, no basis for an estimate of the number that would be interested and have the capacities to perform tasks involved in agricultural or kindred occupations.

In addition to the visually handicapped persons on farms, many in small towns and urban areas are interested in growing plants and shrubs, raising gardens, and operating or working in greenhouses.*

B. Authorization and Cooperating Agencies and Groups

This project was made possible by the Office of Vocational Rehabilitation, U.S. Department of Health, Education, and Welfare, under Section 4 (a) of the Vocational Rehabilitation Act. P. L. 565, 83rd Congress.

C. Objectives

In establishing the curriculum and organizing the program, the specific objectives of this project were as follows:

1. To make experiments on and demonstrate the effectiveness of different methods of instruction and the perform-

*Foot note: As a result of the many requests for technical information on methods and techniques of instructing blind persons in horticulture, as well as for methods used by blind persons in the growing of plants and shrubs, the Division for the Blind, Library of Congress, made a search for instruction books and texts which could be published in Braille and Talking Books. Those found were made available through the regional libraries distributing reading matter for the blind. An abundance of information on the growing of plants and shrubs is available at libraries, colleges, research centers, and public book stores. Unfortunately, after careful study, reviewers at the Division for the Blind, found only a small amount of material appropriate for instructing blind persons in performing the tasks involved in the growing of plants and shrubs.

ance of tasks by blind persons in growing of bedding plants, cut flowers, bulbs, shrubs, and fruits trees, which would make a substantial contribution to the rehabilitation programs of Vocational Rehabilitation Agencies, schools and individuals.

2. Devise ways and means by which a blind person, with little or no sight, may achieve the same horticultural objectives as a sighted person.
3. Initiate, plan, and conduct a course of training in horticulture for blind persons 16 years old and over.
4. Stimulate interest and expand opportunities for employment of the blind in horticulture and kindred occupations.
5. Furnish information on successful methods and techniques to interested agencies, institutions and individuals, and cooperate with the Services for the Blind in the Vocational Rehabilitation Division in preparing information for distribution.

D. Personnel

1. Project leader and resident personnel

It was determined initially that the following personnel would be needed:

HORTICULTURIST - Instructor and Supervisor of Training
ASSISTANT HORTICULTURIST - Instructor
GREENHOUSE ATTENDANT
SECRETARY - Half-time

It was believed that this combination of personnel would make the operations effective and efficient, and permit approximately twelve adults and twelve to fifteen high school students, over 16 years of age, to be trained during the twelve months period. It was thought groups of three to five persons could work together and be trained on a more personal basis than could larger groups.

2. Advisory Committee

In planning the course, advice was sought from specialists in approved universities, colleges, and schools of agriculture. Instructors had to be qualified to teach horticulture, and be familiar with teaching methods thought to be effective in conveying information to blind persons. Specialists from colleges of agriculture, representatives of the State Agricultural Extension Service, greenhouse operators, and dealers in plants and shrubs, were invited to planning conferences, and later to lecture occasionally on various phases of horticulture. Texts, pamphlets, and mimeographed ma-

terials approved by schools teaching horticulture, were used as sources of subject matter. Dr. F. E. Johnstone, Jr., Chairman, Division of Horticulture, University of Georgia, Athens, Georgia, was appointed technical advisor. Dr. Dale V. Sweet, Assistant Professor of Horticulture, University of Georgia, later was appointed assistant advisor.

The technical advisor was instrumental in setting up an advisory committee to assist in choice of physical facilities, to help outline a study program, and to aid in evaluation and improvement of the project as it progressed. The committee was composed of greenhouse and nursery operators. It met at the Academy three times each year to review the program. At each meeting, the committee was oriented on developments, especially in regard to the problems blind persons have in daily living. Primarily, the advisory committee was invited to offer suggestions for improving the program. The committee often suggested specific jobs for which blind persons might be trained and placed in employment. It recommended that trainees specialize in a few limited areas so as to become as proficient as a sighted person in the specialty.

CHAPTER II — RECRUITMENT OF TRAINEES

A. Procedure

Vocational Rehabilitation Counselors for the blind located and referred prospective trainees, many of whom were on their case loads. Some trainees were referred by the Superintendent of the Academy and agencies such as welfare departments, health departments, County School Superintendents, and interested nurserymen and greenhouse operators. Several trainees were enrolled from among the clients at the annual summer adjustment and orientation center for adults at the Academy.

B. Qualifications of Trainees

Trainees selected met the legal definition of blindness, i. e. having a central visual acuity of 20/200 or less, in the better eye with corrective lenses. Persons with secondary physical or mental handicaps were accepted. Several diabetic, epileptic, and low I. Q. cases were trained rather successfully. All of these cases met the vision requirements. Greenhouse and nursery work requires bending, reaching, stooping and lifting. Physical ailments, which interfered with such activities, did handicap some trainees.

C. Problems of Recruitment and Maintaining Enrollment

The principal problem in recruitment was getting clients to consent to leave home. The reasons given for unwillingness to leave home were as many and varied as the clients themselves. Persons who were settled in family life were hesitant to leave. Family members were equally reluctant to part with their loved ones. Quite often the person involved was the head of the family

and had responsibility for major decisions involving the family life. In many cases, however, the handicapped individual simply feared new experiences and hid behind excuses. Some were highly conscious of visual deficiencies and were afraid new experiences would further point up their inadequacies. Family members often were quite as fearful and apprehensive for the prospective trainee as he was for himself. They, too, resisted these new experiences, both for themselves and for the handicapped individual.

Some blind persons contacted had been without employment for long periods. They appeared to have lost the will or desire to accept responsibilities even in a protected training environment. Having experienced a minimum of responsibility since the loss of vision, they could not visualize what they might accomplish under the new situation.

Many trainees were from rural or small-town communities where the environment was relatively stable and uniform. The urban environment they encountered in Macon presented new values and demands which tended to threaten their sense of adequacy and security. They had experienced less opportunity for psychological and emotional adjustments than urban citizens. This relative lack of adaptive experience had to be appreciated as one of the major inhibiting factors in the behavior patterns of trainees.

Quite frequently the prevailing thought patterns of the community played an important role in determining the attitude and response of the newly-blinded individual. If the prevailing attitude was one of pity, the newly-blinded individual found it difficult to adapt to a useful life. On the other hand, if the community anticipated responsibility and positive action from the newly-blinded person, he was more likely to rise to his new problems and approach them in a constructive and positive manner.

Adequate orientation and adjustment training, as a preliminary to the horticultural training, often removed or minimized the fears and inhibitions of the trainee, and he became interested and appreciative.

CHAPTER III — BUDGET ANALYSIS

A. Source of Funds

The budget was set up on a participating basis between the Office of Vocational Rehabilitation, U. S. Department of Health, Education, and Welfare, and the Division of Vocational Rehabilitation, Georgia Department of Education. The Office of Vocational Rehabilitation allocated two-thirds of the necessary funds. The Division of Vocational Rehabilitation contributed one-third of the necessary funds in greenhouse and nursery operations at the Georgia Academy for the Blind.

B. Use of Funds

The conditions governing the award as set up by the Office of Vocational Rehabilitation were: Funds granted were to be used for the conduct of the project as approved, in accordance with the terms of the approved project budget and application. Whenever the approved plan of operation or method of financing was materially changed, the grantee was instructed to request that the project be revised. Such revisions were to be made in writing, and were subject to the same review as a new project application. Funds could not be obligated or expended prior to the beginning date or subsequent to the ending date shown for the grant period. Federal funds were not to be used to provide training to any individual in any one course of study extending for more than two years. The relationship of the grantee contribution and the Federal grant award to the total project cost established a ratio which had to be adhered to in project expenditures. The grantee was expected to expend the approved OVR grantee contribution.

Grantees in this type of project are expected to observe the approved budget categories in expenditures of funds. Transfer of funds between categories must be made in accordance with the general instructions for keeping financial records.

C. Record Keeping

Grantees must make required reports and maintain necessary records and accounts, including property and financial controls, to assure a proper accounting for funds. These records must be readily available for audit purposes.

D. Reports and Control

The Director of the Office of Vocational Rehabilitation may initiate a revision of any project, if reports indicate that Federal funds are being ineffectively used, or if changes are made in Federal appropriations, laws, regulations, or policies governing Section 4 of the amended Vocational Rehabilitation Act.

Various reports were made to the Office of Vocational Rehabilitation such as the semi-annual report rendered for informational purposes.

E. Budget and Costs of Operations

The total combined allotments and expenditures by years, and costs of operations, are shown in Table I.

State funds were sometimes used to supplement Federal Funds in excess of the agreed percentages.

CHAPTER IV — TEACHING TECHNIQUES

A. General

1. The Adult Program

The adult training program was organized around an eight-hour day with week-end duty once each four weeks. The entire

Table I—A Budgetary Breakdown of the Cost of Operation of the Project

Category	Year	1	2	3	4	Totals
Salaries	**	6,413.60	9,283.00	11,366.00	12,503.00	39,565.60
	***	5,096.82	7,853.74	11,814.00	12,933.40	37,697.95
Travel	**	304.40	500.00	850.00	850.00	2,504.40
	***	81.58	482.46	578.28	476.00	1,618.32
Equipment	**	3,735.00	1,270.00	1,450.00	0.00	6,455.00
	***	3,314.54	2,019.84	670.06	0.00	6,004.44
Supplies	**	1,380.50	1,230.00	2,900.00	2,900.00	8,410.00
	***	2,033.24	4,220.02	2,641.92	3,330.15	12,235.33
Vocational Rehab.	**	10,100.00	6,794.00	7,756.00	4,756.00	29,406.00
	***	3,068.02	6,224.37	7,599.95	3,076.00	19,968.94
Admini-station	**	1,700.00	2,000.00	2,000.00	5,000.00	10,700.00
	***	2,123.35	1,673.02	2,207.66	2,754.46	8,758.49
Total Allotted		23,633.50	21,077.00	26,322.00	26,009.00	97,041.50
Total Used		15,717.55	22,483.45	25,511.87	22,570.61	86,283.48
Balance					* +3,000.00	* +3,000.00
Per Year		+7,915.95	—1,406.45	+ 810.13	+ 438.39	7,758.02

*Includes amounts encumbered for this report. **Allotted. ***Used.

program of training consisted of twelve months with a one-week summer vacation, one week at Christmas and a total of a week for various holidays.

The first thirty days of the training course consisted of an orientation period. During this time trainees received a general lecture and demonstration series on greenhouse and nursery operation. Most of these lectures were given at least twice and the demonstration series several times. During this time the greenhouse staff evaluated the potentialities of the trainees and decided whether they should be placed primarily in greenhouse or nursery work.

Also during this period the trainee decided whether he was interested in greenhouse work. If not, he was sent to a Vocational Rehabilitation Counselor for further evaluation.

The first hour each day was devoted to lectures and demonstrations by the greenhouse staff. At this time, a new subject was assigned or a previous subject continued. Usually, during the orientation phase, a different lecture was given each day for the first two weeks and repeated during the subsequent two weeks. After the orientation phase, lectures were given on specific subjects in definite series. As an example, twenty lectures were given on commercial chrysanthemum growing, all of which were in a series, and then reviewed periodically as the seasons changed.

After the first hour of lecture, trainees were assigned a definite task for the remainder of the morning, during which time the trainees were individually coached and trained by the greenhouse staff. All points covered during previous lectures were reviewed individually with each trainee as the need arose. A ten - minute review period was held immediately after lunch each day to adjust job requirements or questions which had arisen. At this time, the

trainees were assigned additional jobs for the afternoon period. At the end of the day, a thirty-minute clean-up period was held. All trainees participated in order to train them in the fundamentals of greenhouse sanitation practices.

The greatest problem in cleaning up was keeping the trainee oriented to his surroundings. A systematic arrangement was found essential for this program.

After a description of the operation was given, each trainee was instructed individually. A sighted persons demonstrated and corrected procedures for complicated tasks. For example, in setting plants in "outside beds" or in greenhouse benches, the forefinger is used to punch a hole for small plants. As the finger is withdrawn the plant is placed in the hole. The finger remains in contact with the edge of the hole until the soil is packed around the roots. A slight depression is left for water and the plant firmed with dry soil after watering. In teaching this operation, each movement was explained and demonstrated with the trainee participating.

The trainees were taught to recognize plants by odor, texture, shape, spines, hairs, tendrils, stem shape, etc. Long hours and persistent practice were necessary in order to learn the plants usually grown.

Insofar as possible similar techniques were used to train visually handicapped individuals as are used to train sighted individuals. This was difficult but the instructors were persistent in this thinking because blind individuals in competition with sighted individuals cannot afford to have very many aids in the greenhouse and nursery. Nothing can replace enthusiasm and patience with the visually handicapped individual by the instructor in this type of training program.

2. The High School Program

A high school program in horticulture for students 16 years or older was organized. It continued for nine months each year, with four lectures and a demonstration and participation lab each week. Enrollment in each class was limited to six students who showed aptitude and interest. The first year, high school students received a course in general and basic horticulture. The second year they received a course in plant propagation of all types. General propagation, seedage, and specialized vegetative propagation were discussed in detail. The third-year students received a course in basic plant physiology as related to horticultural endeavors.

Students took notes in Braille, as no Braille texts in horticulture were available. A demonstration and participation lab was held in the greenhouse once each week. Plant identification and nomenclature were stressed in all three years of high school lab work.

B. Mechanical Aids

Mechanical devices were developed to aid trainees in performing certain jobs. The aids proved to be of considerable value in enabling blind individuals to compete with sighted persons. Although developed primarily for the totally blind, it was found the devices also could be used to advantage by partially sighted persons.

The first aid developed was a wire stretched between two stakes about two feet above rows of nursery plants which were to remain in place for a year or longer. A crimper or pliers was used to kink the wire above each plant. The trainee could feel along the wire until his hand reached the kink, which identified the location of the plant. (See figure 1) Weeds and grass then could be removed from the row with a short handled hoe, or pulled by hand.

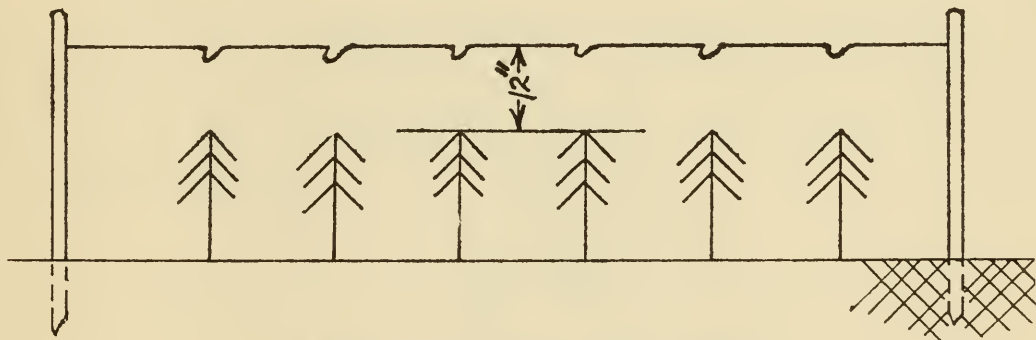


Figure 1—Crimped Wire Guide

A similar aid made of cord with knots at intervals was used to set plants, moving it from row to row as needed. (See Fig. 1 A) Efficient use of these aids depended upon successful instruction in identifying crop plants and weeds.

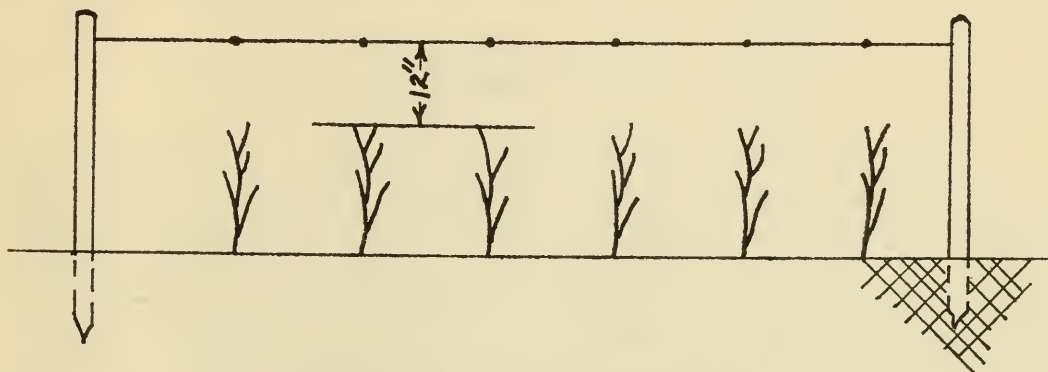


Figure 1A—Knotted Cord Guide

In making outside flower, shrub, or vegetable beds, two lines of cords were placed parallel at desired distances. The trainee turned the soil between the two cords with a fork. The soil between beds was used to build up the beds. After the strings and stakes were removed, the raised beds served as a guide for future

operations. (See Figure 2). A twelve-inch notched board laid across the beds was used as an aid in planting. To space distance between rows, the board was turned over to give twelve-inch spacing or twice to give 24 inch spacing. (See Figure 3). The planting was done along the edges of the board at the notches.

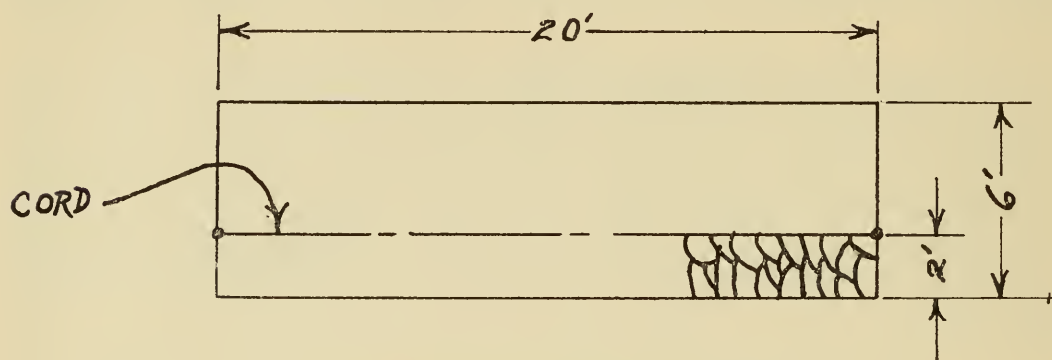


Figure 2—Parallel Strings

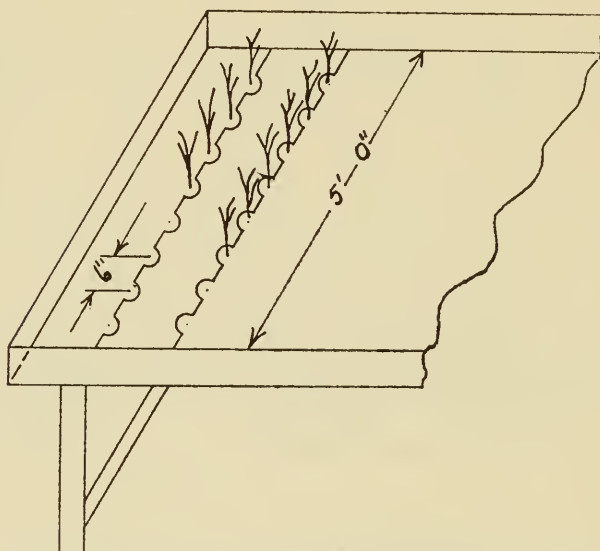


Figure 3—Notched Board Planter Guide

Another aid was devised to space all types of small bulbs and small plants in outside beds or greenhouse benches. A plywood board 5' x 8' with 1" holes bored on 6" centers was prepared. (See Figure 4). The board was laid on the prepared bed and a dibble used to punch holes in the soil. After all holes were punch, the board was removed. The holes in the soil could be located by touch. Plants and bulbs were placed in each or alternate holes as necessary for proper spacing.

An ordinary garden hoe was modified for use by shortening the handle to apporximately fifteen inches. This type hoe was used with one hand while the trainee felt along the plants with the other hand. Rakes, weeders, and other hand tools can be modified in the same manner.

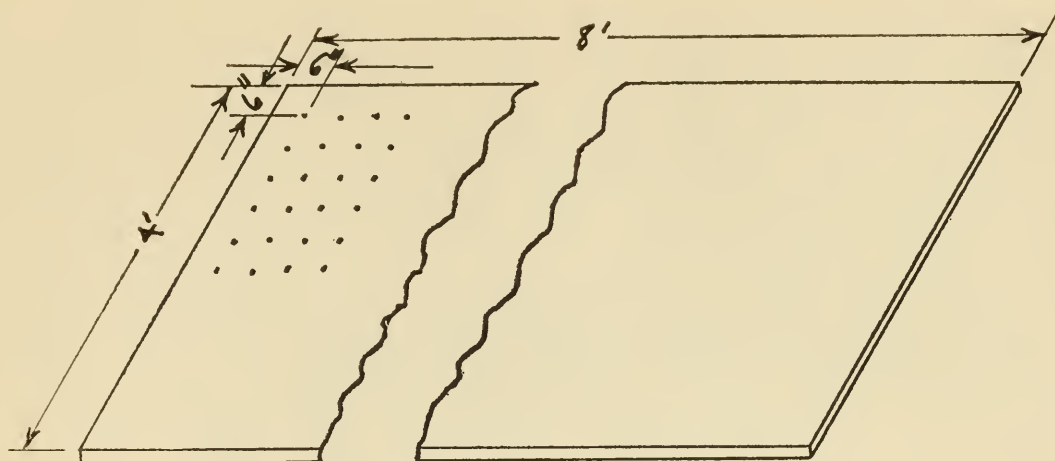


Figure 4—Plywood Board Spacer

Ordinarily, in planting seed in flats or boxes, the flat is filled three-fourths full and smoothed with the hands without firming. A device was designed for smoothing to the flat specified level. It consisted of a narrow board, six inches longer on each end than the width of the flat. The board was moved back and forth across the flat in the side position in order to smooth and remove excess soil. (See Figure 5).

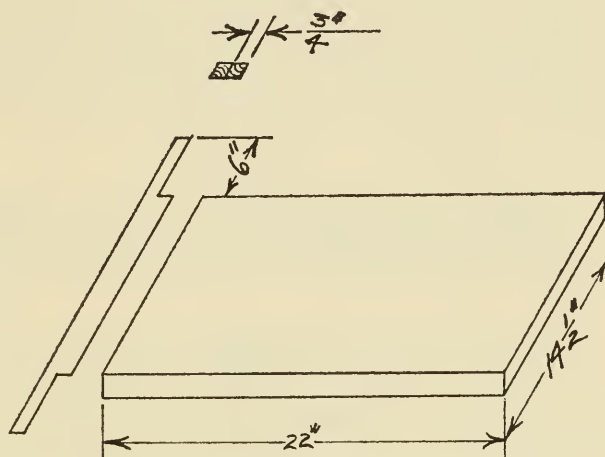


Figure 5—Leveler for Seed Flats

Another aid used to plant seed was a frame made to fit inside a flat. A crosspiece with a flat approximately one-fourth inch wide provided a guide for pressing rows in the soil. After each row was pressed, the crosspiece was moved to the next row. (See Figure 6 & 6 A). A later variation was made with a complete set of crosspieces for the entire flat, so that all rows could be depressed in one operation.

In planting small seed such as petunia, coleus, and begonia, a patented seeder was tried without success. So another device was developed. (See Figure 7 & 7 A). It had eight grooves for eight rows of seed to match the depressions formed by the previously-

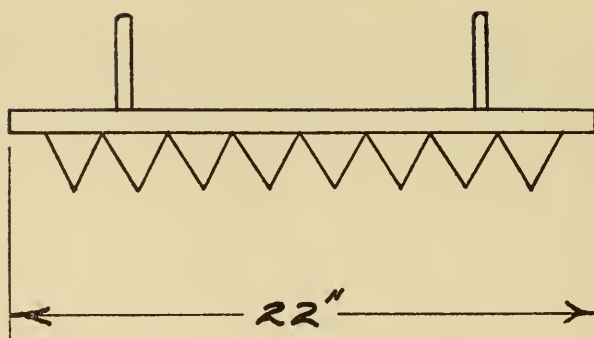


Figure 6—Multiple Row Marker

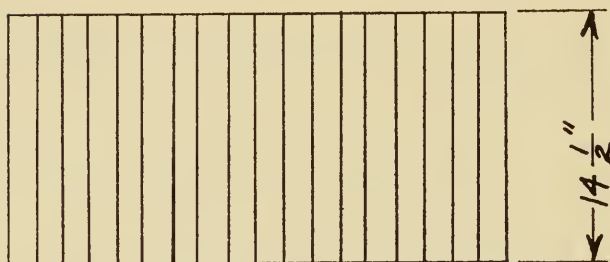


Figure 6A—View of Flat After Bed Preparation

described row-forming device. A stiff smooth piece of cardboard was used to form a bottom under the grooves. The seed were placed in the grooves and smoothed out to the proper space. Then the cardboard was pulled out at right angles to the grooves. As it was withdrawn each successive row of seed dropped into place. The row-forming device was then used to press the seed into the soil.

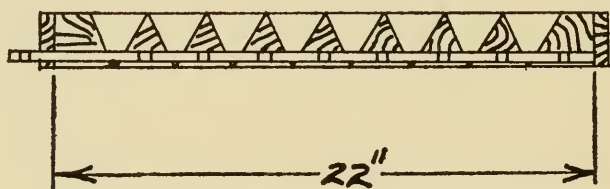


Figure 7—Multiple Row Seed Planter

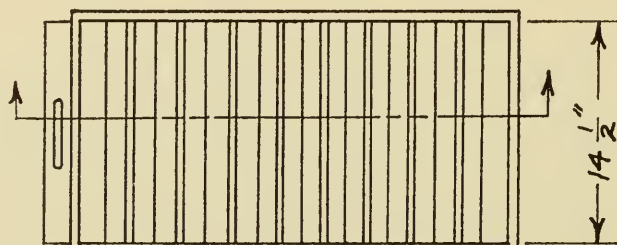


Figure 7A

When large seed such as dahlia, aster, and zinnia were planted, the same sowing device was used to cover the seed with soil or other media. The soil was placed in the grooves and the "land-board" pulled out, covering each row as it was withdrawn.

For potting cuttings of mums, fuchsias, and some other plants, an aid was devised consisting of a disc smaller than the diameter of pot. It had a handle on the top and pegs on the bottom. (See Figure 8). The pegs were 2" long and tapered from one inch in diameter at the top to $\frac{3}{8}$ " at the bottom. They were fastened to the disc at a specified distance from the rim, according to pot size and number of cuttings. When soil of good structure was used, the pots could be filled to the top. In pressing the holes, the soil was firmed to three-fourths inch from the top rim of the pot. The plants were then placed in the holes, slanting toward the outside, and thoroughly watered. No packing of soil around the roots was necessary in this type operation.

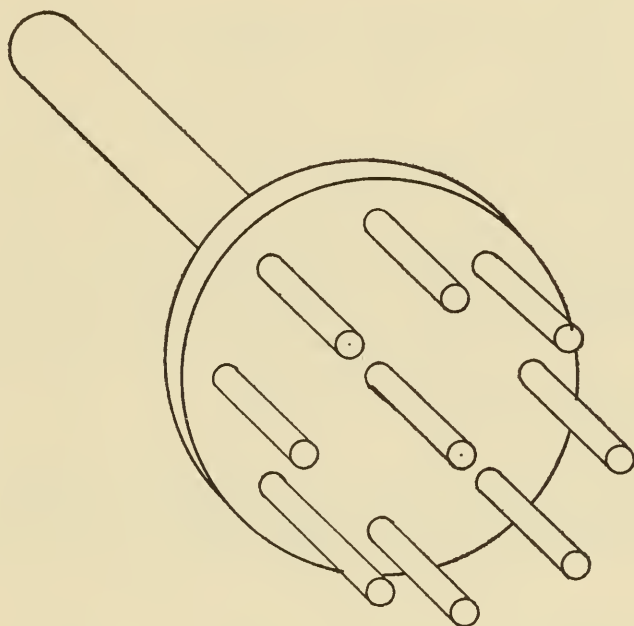


Figure 8—Multiple Potting Dibble

Similar planters for different shapes and sizes of container for small seedlings were also devised. They had pegs 1" in length, tapering from $\frac{3}{4}$ " to $\frac{1}{4}$ ". (See Figure 8).

An aid to insure straight rows in setting cuttings in flats or benches was developed. This was a simple T-square made to fit over the edge of the bench and used to make parallel rows across the bench or flat. The T-square should be made of water-proof material. It also should be heat resistant so that it may be sterilized between each period of use. (See Figure 9).

C. SPECIFIC TRAINING PROCEDURES

The eleven training operations described here were used as a basis for grading and evaluating trainees. They were selected because they are important and have methods which can be checked and graded.

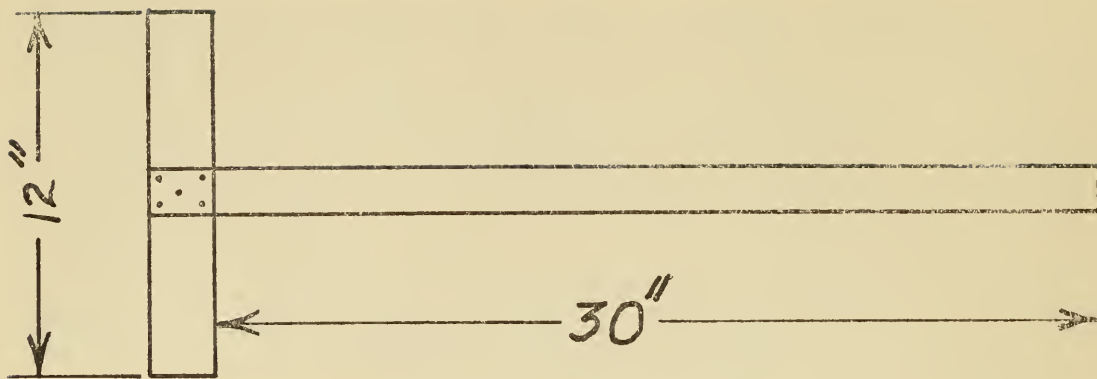


Figure 9—T-Square Guide

Procedure No. 1 - Potting Seedlings in Small Pots.

The trainee selects a flat of seedlings from the propagation house area when the seedlings have two true leaves. Seedlings are thoroughly loosened in the medium with a label or some flat instrument to lessen root damage. Each row must be loosened separately. No more seedlings are removed from the flat than can be satisfactorily potted in a fifteen-minute period. After being taken from the flat, seedlings are placed in a V-shaped tray in an orderly manner and put on the bench to the left or right of the potter, which-ever is more convenient.

All pots are placed on the bench with the open end toward the potter. They are placed to the right of a right handed potter so he can reach them with the right hand and a seedling with the left hand.

When the potting operation begins, trainee places the pot in front of him. The seedling is held by the thumb and forefinger of either hand, in the center of the pot with the little finger supporting the roots. With the fingers extended and palm up, the soil is lifted in one motion and placed in the pot with a circling motion around the seedling. As this motion is completed, the thumb and forefinger of both hands are used to firm the seedling in the center of the pot. The completed pot is removed from the bench and placed in a flat to the left or right of the potter. The procedure should be repeated exactly and slowly until the potter becomes skilled in his motions. After the proper motions are established the procedure is speeded up to increase the number of plants potted per hour.

When a flat of potted seedlings is filled, it should be removed to the growing area and immediately watered with a fine spray or mist until thoroughly wet. Labels are placed on flats to identify each variety.

ITEMS FOR EMPHASIS IN INSTRUCTION

1. Method of handling seedling
2. Securing pot from stack
3. Securing soil from bench
4. Method of packing soil
5. Amount of soil used
6. Method of disposing of potted seedling
7. Method of watering
8. Organization of necessary material for job

Procedure No. 2—Potting Cuttings in Small Pots

Softwood or hardwood cuttings are selected from the propagation area when the roots are $\frac{1}{4}$ " to $\frac{1}{2}$ " long.

The cuttings should be thoroughly loosened with a trowel and placed in a cutting tray. If they are in flats, a complete flat can be removed from the propagation house and taken to the potting shed. Roots must be kept moist either by misting or with damp sphagnum moss. The rest of the procedure is identical with that for potting seedlings.

Procedure No. 3—General Spraying and Fumigating

The aid of a sighted partner is essential in this operation. In selecting and handling all sprays and fumigants, proper safety precautions must be observed. These can be determined by the sighted partner reading the label on the container.

With the aid of the sighted person, the visually-handicapped trainee mixes the proper amount of spray material according to directions on the container. All spraying is done with nozzle turned alternately up and down and to the sides so as to cover both sides of leaves and stems. Too much spray will cause drip and not enough will fail to obtain the desired results.

After all plants have been treated, any remaining material is removed from the sprayer and the sprayer washed thoroughly.

In fumigating a greenhouse of plants, the trainee closes the greenhouse tightly and posts all doors with "danger" signs. A gas mask of the type recommended for the fumigant being used is worn while fumigating, or in a fumigated house prior to airing. The trainee should adjust the gas mask straps to fit his needs. Protective clothing is recommended. However, long sleeved high collared, work clothes which can be washed after each use are satisfactory.

The fumigant is distributed by rotating the nozzle and not pointing it directly at any plants. As the trainee distributes the fumigant, he walks toward the exit. The fumigant must be cut off before the trainee leaves the greenhouse.

All doors should be locked to keep other persons out of the greenhouse. After fumigating, the trainee should take a bath and change clothes as a precautionary measure.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Safety precautions
- 2.. Method of mixing sprays
3. Method of applying spray

Procedure No. 4—Propagation by Cuttage

The trainee selects cuttings from stock plants that have the most desirable characteristics, according to instructions received in lecture.

Some cuttings of a soft nature are pinched off. Others of a firmer type wood are cut off with a sharp knife. If the cutting is of the hardwood type, pruners may be used instead of a knife.

Cutting instruments are sterilized by alcohol, steam or boiling water. The method used to sterilize is not important so long as it is done. The instruments are sterilized before and after each batch of cuttings is taken and occasionally during the process to prevent the spread of fungal and bacterial diseases.

Root-promoting substances are applied to certain kinds of cuttings. These materials may be in liquid or powder form. The powder form was used on the project. Several cuttings are grouped together and rotated in a cup or glass containing the powder to cover the lower $\frac{1}{2}$ " to 1" of the cutting.

Sanitation is important in all phases of taking and handling cuttings. Surplus cuttings should not be left on the rooting-bed during sticking operations.

A small amount of cutting wood is taken at one time so that the cuttings will not dry out. Cuttings are kept moist during the operation to help prevent dessication.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Method of selecting stock plants and cutting material from plant
2. Selection of cutting instrument
3. Method of sterilizing instruments
4. Method of making cutting
5. Method of applying rooting hormone
6. Application of aseptic techniques in handling

Procedure No. 5—Disbudding Chrysanthemums

The trainee selects plants with buds large enough to be easily distinguishable by touch. Buds should be from $\frac{3}{8}$ " to $\frac{1}{2}$ " in diameter. Smaller buds are not easily distinguishable by feel. Larger buds are not easily removed from the stem.

For single stems and large flowers, the plants are disbudded from top to bottom. If the terminal bud is accidentally broken, the next remaining one can be selected. When the plant is disbudded from bottom to top, the terminal bud will be the last remaining one. If broken, the stem has no bud and is useless. Right handed



Two trainee (left and third from left) with Hugh Bryan, Agricultural Specialist, Vocational Rehabilitation (second from left) and Earl Hester, Horticulturist, and two members of Advisory Committee (at right).



Dr. Johnstone and trainee. This woman operates her own greenhouse, supplying plants and flowers to the retail trade.



Blind man on job in commercial nursery.



With only 3 per cent vision in one eye, this man operates his own greenhouse.

trainees use the thumb of the left hand to protect the terminal bud. The plant is disbudded with the right hand. Buds are rolled out to the side of the leaf axil with the thumb and caught with the same hand and deposited in a handy refuse container. They are not pinched. The forefinger and index finger are used to steady the plant stems. Buds left on the stems count as much against a perfect score in disbudding as terminal buds or broken leaves.

After some experience, the trainee will learn to disbud on both sides of the stem, using both hands. In disbudding mums, the trainee determines by feel the number of plants usually potted in each pot. He must think of the pot as a clock, and start at "12 o'clock" and proceed clockwise until all stems have been disbudded.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Selection of plants to be disbudded—stage of buds
2. Method of disbudding plant, top to bottom, around, outside and in
3. Number of terminal buds and leaves broken
4. Number of buds left on plant
5. Method of disposing of buds

Procedure No. 6—Tying Chrysanthemums

The trainee selects the best methods of staking chrysanthemums using the one-stake, three-stake, or multiple stake method.

Single stakes are used for relatively short mums. The stake is placed in the center of the pot, and each plant tied individually.

The three-stake method is more frequently used for normal high quality mums. The stakes are set on the outside edge of the soil in a triangle, and the strings tied loose from stake to stake.

The multiple stake method is used when plants are bent over or have heavy blooms. A stake should be set on the outside of each plant, and the plant tied to it. The length of the stake may be varied to suit the plants.

In tying, close but not binding loops and knots are essential. Loose and ragged ends of string detract from appearances and must be avoided.

If the trainee removes the plant from the bench for tying, it is replaced in the same spot that it was before. The post must be level and in line with other plants on the bench. The trainee should be careful not to damage other plants in removing and replacing pots.

It has been found that a board placed across the aisle, with a place for string, stakes and pots of mums in the center works well for visually-handicapped individuals.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Selection of best method of staking
2. Proper amount of string used, and proper length of stake
3. Placing stakes in pots, place, depth, angle
4. Has general form of plant been improved?
5. Replacement of plant on bench

Procedure No. 7—Pinching Mums

The trainee determines the date for pinching each variety. In pinching, only the tip of the stem should be pinched out. Usually, about $\frac{1}{2}$ " to 1" of the stem is removed. No chrysanthemum should be pinched back far enough to get into the hardened stem. All are pinched to a uniform height in each pot. All pots are not necessarily pinched to the same height. However, the trainee should use the same clockwise method of keeping account of completed plants as in disbudding.

Waste material dropped on benches or in pots counts against the trainee. The trainee locates the label on each variety or group and marks the date of pinching. This is done immediately after the pinching has been completed.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Pinching to uniform height
2. Recording pinching date on label
3. Disposing of waste material
4. Clockwise system used

Procedure No. 8—Potting Mum Cuttings in 6" Pots

Potting mum cuttings is similar to potting cuttings from propagation benches, as described in Procedure No. 2. Only important differences will be described here.

Most mum growers buy rooted cuttings from one of several sources. The trainee is taught to unpack the mum cuttings from the propagator so as to keep the varieties separated. The cuttings are sized and graded before being potted. Equal grades and sizes are used in each pot.

Pots are labeled from left to right as they are placed in the bench, with the variety name, date of potting, prospective date of pinching, prospective date of lighting or shading and prospective date of flowering on the label.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Organization of necessary materials
2. Unpacking mum cuttings from propagator
- 3.. Grading and sizing cuttings
4. Method of obtaining pot from stack
5. Use of draining material
6. Amount of soil used and method of obtaining soil from bench
7. Method of placing cuttings in pot
8. Method of packing soil
9. Method of watering in potted cuttings
10. Method of placing pots in bed, bench, or frame
11. Method of labeling (Front to back, left to right)

Procedure No. 9 - Placing and Spacing Pots in Bench.

Before pots are placed the bench is cleared of old material and foreign matter, and sterilized, by one of the methods previously taught. Similar new material is added if needed.

If a type of material is to be placed in the bench, the trainee selects it to suit the crop to be grown. Generally, a medium-sized gravel is satisfactory for most crops. During the summer, a small amount of sand is added to help conserve moisture.

Leveling of pots in the benches is essential for proper watering. This is a difficult operation for the visually-handicapped. Careful supervision is necessary for the trainee to master the technique.

Straight alignment and accurate spacing for the crop to be grown are also important to watering and working.

Pots are spaced according to the anticipated growth of the plants. They should be spaced further apart for a fast-growing crop than for a slow growing one to save labor of frequent respacing.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Application of Aseptic techniques
2. Selection of suitable draining material
3. Leveling of pots
4. Keeping rows straight
5. Selection of correct spacing
6. Check spacing from side of bench
7. Spacing plants according to anticipated growth of specific crop

Procedure No. 10 - Sticking leafy cuttings

It is the responsibility of the trainee to know from previous classroom instruction how to select the proper media for the type of cutting being stuck.

The trainee also is shown the proper distances, depth, and slant for placing cuttings. The cuttings should never be allowed to dry off or wilt during preparation and sticking. Use of plastic bags, frequent watering, misting, and wrapping in moist paper are methods generally used to prevent drying out.

Aseptic techniques must be used in handling and sticking cuttings. Grading trainees in use of aseptic methods is difficult.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Selection of media
2. Care of cutting prior to sticking
3. Method of sticking
4. Spacing of cuttings in media
5. Watering of cuttings
6. Method of labeling cuttings
7. Aseptic techniques

Procedure No. 11 - Watering

The trainee should inspect frequently the plants to determine the need for water. This can be done by feeling the outside of the pot to determine if it is moist, or by feeling the soil in the pot. Careful individual instruction and trial and error methods are necessary to perfect the trainee in either of these methods.

Moisture meters with Braille or print dials and buzzers connected to the meters and calibrated to buzz at a given moisture concentration are helpful but probably too expensive for most operations except sampling. Wilting of plants usually indicates need for watering, but may be deceptive.

The trainee selects the proper nozzle for watering a particular crop, or, in some cases, decides not to use a nozzle. For plants watered on the foliage, a syringe-type nozzle is used.

Water flow is adjusted before the operation, to supply the maximum amount of water to control damage to plant roots and foliage. The trainee waters the pots from right to left, if the trainee is right handed. By this method he can find the next pot with the left hand while still watering with the right. In this way, no time is lost from pot-to-pot, and wastage is kept at a minimum. Timing by counting after establishing a norm for the pot being watered, is the best way to determine when a pot has received enough moisture.

It has been found that feeling the water with the hand is not an accurate indicator as to the amount applied to each pot. The finger tips will be the same temperature as the water after a few pots are watered, and the trainee cannot determine how much water has been applied. After the water is turned off, the hose is stretched out under the bench in its customary location.

ITEMS FOR EMPHASIS IN INSTRUCTIONS

1. Method used to determine need for water
2. Selection of proper nozzle
3. Adjustment of water flow
4. System used in watering rows, etc.
5. Amount of water used.
6. Preventing water waste
7. Care of hose
8. Placement of hose in proper location

D. Methods of Determining Trainee Progress

The eleven operations described here were considered the most important jobs in this type of training. They were selected for grade basis because they were performed often and regularly. As an example, mum cuttings were potted each month during the 12 months' course, whereas potting of poinsettia cuttings was done only occasionally.

In addition to the points listed by number under each job, there were many lesser points that were observed by the instructor in each phase of the operation.

Each month, the trainees were assigned to various operations for an evaluation on a time basis and on proficiency. The operation was graded by the number of units completed satisfactorily in a stated period. The trainees were encouraged to improve from one grading period to the next.

During the 12 months training period, each trainee was graded once a month by operation number. The sample grade sheet (Figure 11) carries a descriptive column for each operation. Units per hour were recorded on this sheet together with grade made and "remarks". In the remarks column, such things as previous experience or lack of interest were recorded for informational purposes only. These informational items were not considered in the grade given by the instructor.

Although speed was stressed in the later stages of training, efficiency was considered more important. In the early stages the motions of each operation had to be mastered thoroughly by the individual before an attempt was made to gain speed.

In addition to the monthly evaluation report, there was a master sheet (Figure 12) made up listing the operation number with twelve columns to record each monthly grade. A "remarks" column was provided for miscellaneous information that did not enter into the grade. This master sheet was retained by the horticulturist so that a complete, concise grade could be given at any time to a prospective employer.

In this program, it was the responsibility of the Counselors for the Blind to place the trainees on jobs after completion of training. For this reason, it was imperative that accurate and complete records be kept to aid the Counselor in placing the trainee in a suitable job.

Time studies have been a valuable part of the project. Each trainee knew he was being tested and was under pressure to work efficiently and steadily.

During the first 30 day period, trainees were given a series of lectures totalling 20 hours. In addition, each received 120 hours of practical training. Towards the end of the first 30 days, they were given their first time test.

INDIVIDUAL TRAINEE EVALUATION SHEET

Name of Trainee:
John Doe

Date	Operation	Description	Units Per Hour	Grade	Remarks
3-30-58	8	Potting mum cuttings	19	70	No previous training
3-30-58	9	Spacing pots	180	75	No previous training

FIGURE 11

INDIVIDUAL TRAINEE GRADE RECORD—MASTER SHEET

Name of Trainee:
John Doe

MONTHLY GRADES													
Operation	1	2	3	4	5	6	7	8	9	10	11	12	Remarks
1	45	45	60	55	60	70	75	75	85	85	85	85	
2	60	65	75	75	85	85	85	90	90	90	90	90	

FIGURE 12

CHAPTER V—RESULTS

A. In Terms of Completion and Employment

During the four years of the project, 45 trainees were referred by Counselors for the Blind in Georgia and other states. The results of the training program are set forth in this chapter.

In table II, the statistical results, in terms of enrollment, completion, and subsequent employment status, are summarized by years. The first year was utilized in organizing, assembling a staff, construction of physical facilities, and obtaining supplies and equipment. Trainees were accepted during the second and subsequent years.

Table II. Enrollment, Completion or Termination of Training, and Employment Status 30 Days after Termination of Trainees Accepted in the Project.

Budget Year	1	2	3	4	5	Totals
Number Enrolled	0	6	17	12	10	45
Number Completing Course	0	0	6	7	7	20
Number Completing (Employed)	0	0	6	6	6	18
Number Completing (Not Employed)	0	0	0	1	1	2
Number Not Completing Course	0	6	11	5	3	25
Number Not Completing (Employed)	0	2	4	4	2	12
Number Not Completing (Not Employed)	0	4	7	1	1	13

Most of the termination at the end of the first 30 days were due to lack of interest or aptitude, or to a poor attitude on the part of the trainee. Trainees who were terminated in the 2nd, 3rd, 4th, and 5th months usually left of their own accord. Trainees terminated at the end of 6 months either had a job in prospect or were kept in the project because the staff felt they might develop some interest or aptitude. Sometimes the attitude was good, but there was no interest in this particular type of training.

Trainees who terminated in the 7-9 month period had been employed. Nineteen trainees were in training for a period of 12 months. One of these remained an additional 60 days for specialized training to enable him to accept a specific type of employment.

The policy adopted by the staff was to orient and evaluate each trainee during the first 30 days and then to terminate or continue his (or her) training in accordance with the findings.

Trainees ranged in age from 16 to 59. Seven were under 20 when enrolled. Sixteen were in the 20 to 30 year age group, most of them in the low 20's. Only eight were in the 30-40 group. Fourteen were 40 or older. This is summarized in Table III.

Table III—Age Group Table

Age	Under 20	20-30	30-40	40+
Number	7	16	8	14
Per Cent of Total	15.55	35.55	17.77	31.11

The educational level of the trainees is shown in Table IV. Of the eight trainees with 12 or more years of education, four were graduates of the Georgia Academy for the Blind.

Table IV—Educational Level of Trainees

Years of Education	None	1-7	7-12	12+	
Number	3	17	17	8	45
Percent of Total	6.66	37.77	37.77	17.77	

Of the total trainees, 40 were males and five females. The females were all trained during the third year of the project. Of this group, two completed the course and three were terminated. The three who were terminated, before the end of training, were employed in horticultural occupations. One of these who completed twelve months of training was placed on a horticultural job. The other was not employed at the time of completion of training.

Four of the five out-of-state trainees completed the training course. The other, a completely blind male, withdrew for personal reason after four months. Three others planned self-employment in small horticultural businesses. One expected to seek employment in a large greenhouse specializing in holiday cut flowers.

The 35 trainees from Georgia communities were males. Fourteen completed the course. Thirteen of them were employed in horticultural enterprises, and one in a non-horticultural enterprise. Eight of those not completing the course were terminated during the first month of training. Most of them terminated because of lack of interest. Five males who voluntarily terminated training went into employment; four in horticultural enterprises.

All who entered the project were probably helped in some way by the training. Even those who were terminated at the end of the orientation period, gained a little horticultural skill and knowledge.

B. Individual Case Histories

Here are five typical case histories.

Case History A—This single male, age 20, reported during the fourth year. He had a visual acuity of 20/200 and a low I. Q. He had completed the fourth grade at the Georgia Academy for the Blind. He came from a rural background and low economic level. His mother and father were living. There were other children in the family. He completed twelve months of training with below average grades. This trainee was on a borderline basis throughout training. He was best qualified, at the completion of training, to mix soils, stack and handle pots, and perform general clean-up jobs. Upon completion of training no employment was found for him

immediately. After several weeks, he accepted a job in a greenhouse and worked for three months. At that time he left the job because of a disagreement with his employer over wages. The employer rated him a capable, hard working and earnest person. He was placed on another job and is still working.

Case History B—This 20 year old male reported during the first year. He had a visual acuity of 5/200 with no additional handicaps. Single, and a graduate of the Georgia Academy for the Blind, he came from a farm background and low economic level. His mother and father were living and there were other children in the family. He completed twelve months training with good grades. He was interested in horticultural work and there was never any doubt that he would complete the course. He was best qualified to disbud, pinch, and pot chrysanthemums. Generally, he was one of the better trainees. After completion of training he was placed on a job immediately in a greenhouse, growing chrysanthemums. He has continued to work.

Case History C—This male, age 28, reported during the third year for 6 months training. He had a visual acuity of 20/200 with no additional handicaps. He was married and had completed the seventh grade in public schools. He came from a rural background but with little success. This trainee had a family of his own and came from a family with other children. He completed six months training with average grades. He was best qualified to water and fertilize shrubbery, and to pot plants. He was placed on a job in a nursery, but left it to accept a better-paying job as a sales lot attendant in another nursery and is still employed there.

Case History D—This single male, age 20, reported to the project during the third year. He had a visual acuity of 20/200 with an impairment of the limbs. His I. Q. was above average. He had completed the tenth grade in public schools. He came from an urban area and had no experience in agriculture. His mother and father were living and there were other children in the family. He completed twelve months of training with above-average grades. This trainee was interested in the course from the beginning and exhibited an aptitude for horticultural work. He was best qualified at the completion of training, to grow a variety of bedding and foliage plants. He was placed by a counselor in a greenhouse, growing small plants. After several months experience, he left to start a small business for himself and is still self-employed.

Case History E—This female, age 32, reported during the third year. She had a visual acuity of less than 20/200 with no additional handicaps. She was divorced and had completed the fifth grade in public schools. She came from an urban background and low economic conditions. Her father was living. There were other members in the family. She completed eight months of training with average grades and was best qualified to pot, pinch, and disbud chrysanthemums. She was placed on a job growing chrysanthemums in a greenhouse and worked for several months. Her employer stated that she was probably the best trained worker he had hired in 25 years of experience.

C. Effectiveness of Teaching Procedures and Techniques.

For the evaluation of this project, the program has been divided into three phases. Phase one was the 30-day orientation of the trainees and evaluation of their aptitude, interest and attitude. The second phase was the three-months period after the orientation phase, during which the trainee received general training in all types of greenhouse crops and tasks. Six of 45 trainees dropped out during this three-months phase. The third phase was more specific, but continued certain parts of the general program. Dur-

ing this time the trainees were instructed in specific crops and tasks. Individual trainees also specialized on one or several crops.

Since trainees were admitted several times during the year in the first two years, all three phases of training were in progress at the same time. Although this procedure placed a greater burden on the instructors because of the necessity of teaching classes at two or three levels of training each day, it was more economical of facilities and plant materials. During the third year of the project trainees were admitted each four months which allowed the orientation and general phase of training to be completed each time another was started. However, there were still two phases of training going on at all times.

During the fourth year, trainees were admitted only at the beginning of the training year. In this way, only one phase was in session. More time could be given to the individual instruction and demonstration sessions by the horticulturist and assistant horticulturist. However, plant materials were not utilized quite so well. From the standpoint of utilization of instructor's time, it was found the method used during the fourth year was best. Considering efficiency in utilization of facilities and materials, the method used during the third year was preferred. All the methods and techniques described in this report were more or less successful. Specific comments on certain tasks and techniques follow.

Trainees were slow in planting small seed but attained satisfactory results. Desire and interest were more important in this operation than sight. This was an operation in which the trainee took pride after the seed germinated and grew; probably it was more than accomplishing any other single operation in greenhouse and nursery work.

All trainees had moderate success in watering the usual greenhouse and nursery plants. This is a skilled job requiring much patience and practice and most visually-handicapped individuals tried to accomplish the job too quickly.

Weeding in a marked area or around large plants was done by all trainees satisfactorily. Trainees learned to identify plants as they weeded. Even the completely blind trainees were able to weed among very small plants or to weed seed flats.

With the aid of wires, strings, and pre-cut measuring sticks, the trainees were able successfully to line out and bed herbaceous and woody plants. (See figures 1 and 1A).

Learning general propagation was very easy for the trainee. Specialized propagation such as budding was not done for record but was practiced with actual rose canes and buds in the lecture periods. There seems to be no reason why blind persons cannot master most types of propagation. The entire operation of taking, preparing, and sticking cuttings was done successfully.

Many tasks or jobs have been explored in this project. Those tried are listed below, with the instructors' evaluation of their suitability for training sightless-handicapped individuals.

JOB ASSIGNMENT	Evaluation of Adaptability
1. Mixing soils, fertilizer, and organic material	Good
2. Potting of all types of plants and plant material	Very Good
3. Spacing pot plants in benches	Fair
4. Planting of all types plants and plant material	Fair
5. All types of asexual propagation	Good
6. Watering of all kinds of crops	Good
7. Spraying, dusting, and fumigating (with sighted partner)	Good
8. Propagation by seedage	Good
9. Fertilization with liquid and dry fertilizers	Very Good
10. Repair work—faucets, etc.	Good
11. Placing and removing shading materials in the nursery	Poor
12. Tying and disbudding mums	Very Good
13. Preparation of cuttings	Very Good
14. Construction of flats and beds	Fair
15. Coldstorage treatments of bulbs and plants	Good
16. Pruning of shrubs	Very Good
17. Disease and insect detection	Very Poor
18. Shading and lighting flowering plants in greenhouse	Good
19. Preparation of bulbs and tubers for storage	Very Good
20. Temperature control	Good
21. Preparation of plant totem poles	Very Good

Plant used in the project were as follows:

- | | |
|--|---------------------|
| 1. Various annual bedding plants | 12. Geraniums |
| 2. Several types of bulbs | 13. Gloxinias |
| 3. Miscellaneous herbaceous perennial plants | 14. Hibiscus |
| 4. Azaleas | 15. Hollies |
| 5. Begonias | 16. Hydrangeas |
| 6. Camellias | 17. Melior Begonias |
| 7. Chrysanthemums | 18. Orchids |
| 8. Cyclamen | 19. Ponsettias |
| 9. Easter Lilies | 20. Roses |
| 10. Foliage Plants | 21. Strawberries |
| 11. Fuchsias | 22. Tomatoes |

D. Effectiveness of Mechanical Aids

The mechanical aids developed were effective with totally blind trainees and enabled them to complete with sighted persons. Some of the devices were used to advantage by partially-sighted trainees and even by sighted persons to increase efficiency in performance of certain tasks.

The project staff and the advisory committee agree that the mechanical aids used were valuable in this work. The mechanical aids developed or adapted in the course of the project are listed in the following table.

Table V—Mechanical Aids Used Successfully in Order of Relative Usefulness

Descriptive Name of Aid	Brief Note on Usefulness
Multiple Row Seed Planter (Fig. 7 & 7A)	This aid enabled the totally blind trainees to perform planting operations that could not otherwise have been accomplished.
Multiple Row Marker (Fig. 6)	This marker was essential for success in preparation for seed planting.
Multiple Potting Dibble (Fig. 8)	Enabled the blind trainees to pot uniform cuttings approximately as fast as sighted persons.
Notched Board Planter Guide (Fig. 3)	This Guide was of considerable value in outdoor and bed work for planting nursery liners and bulbs. It increased speed.
Crimped Wire Guide (Fig. 1)	One of the best aids devised for row work in the outdoor nursery. It enabled the trainee to find and identify crop plants.
T-Square Guide (Fig. 9)	Effective aid for propagation.
Short Handle Tools	These tools were effective in weeding and cultivating outdoor plants. The trainee could use the tool with one hand and find the plants to be cultivated with the other.
Leveler for Seed Flats (Fig. 5)	Effective in preparing seed flats for uniform seed planting.
Single Row Marker and Planter (Same as Fig. 6 & 6A)	Effective in the first year of the project before the multiple row marker was devised.
Knotted Cord (Fig. 1A)	Effective in setting and cultivating plants where a permanent crimped wire marker was not desired.
Plywood Board Spacer (Fig. 4)	Effective in speeding up the planting of uniform beds and benches for planting of seedlings, liners and bulbs.
Parallel Strings (Fig. 2)	This aid enabled the trainee to prepare planting bed without the aid of a sighted person.

CHAPTER VI - DISCUSSION OF RESULTS

A. Suggestions, Comments, and Evaluation by Advisors and Employers

Recommendations by greenhouse and nursery operators of specific tasks to be used in training were most helpful. One nurseyman suggested more propagation work with shrubs. This was done. Another suggested that trainees be given the opportunity of propagation by budding and grafting. Grafting was tried with moderate success on practice wood only.

Industry advisors, during the early stages of the program, suggested that women be given the opportunity for training. Some of the advisors thought this desirable because many employees in greenhouse are women. Others did not like the idea, nevertheless it was tried. The women accepted were rated "good" upon completion of training. However, it was found they tended to distract the men and disciplinary problems arose. Since facilities at the project were not available to train the women separately, only one class was admitted.

Most of the nurserymen said totally blind persons could not be used in their type of operations because of orientation problems. However, they did think partially-sighted persons could be used to good advantage, if well trained. Some seemed to think there were great possibilities in nurseries for visually-handicapped individuals and that there was an inexhaustible demand for workers in the Southern states. Several advisors have employed persons trained, and they reported good results. Most of those employed have proven satisfactory workers. At least one totally blind man was rated "very satisfactory" by his employer.

Albert Oelschig, Jr., flower grower and nurseryman of Savannah, employed two persons who completed the course. He said, "They are as capable as any sighted persons ever employed by me in greenhouse work. I could use one more like them."

Bob Reed, of Weinstock's in Atlanta, said, "These persons are well trained for the job to be done."

Hayden Teear, of Rosemont Greenhouse in Macon, stated he would hire "another trainee of the same caliber as the two that have been employed by my firm."

The technical advisors thought the psychology of learning to do a few jobs exceptionally well could have a marked favorable effect on certain handicapped persons. They thought it would instill or restore self-confidence. Industry advisors suggested that specialized training might not be as important as the general training. They said special jobs, or particular routines, could be learned after the trainee was on the job, if the general techniques had been mastered.

During the course of the project, several industry advisors suggested that the program be broadened to include landscape maintenance. This was done during the fourth year. One partially-sighted trainee successfully completed this type of training and is employed in the field.

It was thought by the staff that the project definitely benefited from the advice and suggestions given by both the technical and industry advisors.

B. Instructional Problems

It was concluded that a totally blind trainee must be in a close, compact operation with the arrangement of benches, beds and outdoor plants fixed. Partially-sighted individuals can adjust readily to change of plants within beds and benches.

The most important quality necessary in teaching visually-handicapped individuals is patience and persistence. Many points in teaching must be thoroughly demonstrated and repeated several times before the trainees understand them.

It has been established that a desire to do this kind of work and a love for growing plants is more important than eyesight. The instructor must like to teach and the trainee must be persistent and uncompromising in his desire to learn. Quality work and a real knowledge of plants can only be obtained over a period of time.

C. Detailed Discussion of Specific Assignments

Some of the individual types of tasks will be discussed in more detail than was done in the "Results" section to illustrate certain problems and the degree of progress that can be made with the trainees.

In one case, a test on identification of 25 shrubs was given after two weeks study. It was found that three students had made 100%. Of these three, one was totally blind. In the next group of 16 students, including seven totally blind, grades ranged from 70% to 95%. Only two of the totally blind were in the lower half grade level.

Positive results have been recorded on identification of fertilizer ingredients by handling. All trainees and the high school students were able to identify several fertilizer materials. Some were able to identify as many as ten types. Materials used included cotton seed meal, bone meal, superphosphate, muriate of potash, and agricultural limestone. Many were able to distinguish a mixed fertilizer from a pure ingredient, such as 4-12-12 from superphosphate; however, different mixtures cannot be distinguished by totally blind individuals.

The greatest obstacle in training was keeping the trainees oriented to their surroundings. The greenhouse did not present so difficult a problem as the nursery and outdoor areas. However all areas were mastered with persistence and patience by some trainees. Finding stock plants in the open field or nursery presented a most difficult problem for totally blind individuals; however, this might be overcome with a system of wires.

There was no success with totally blind persons in detection of diseases and small insects. Some success was had with the partially-sighted individuals in recognizing small insects, and a few diseases

such as botrytis, root rot, etc. Little success was achieved by the partially sighted individual in detecting diseases such as molds and mildews on the undersides of leaves.

Potting was perhaps the most practiced job in the training program. Most of the trainees became proficient in potting. Many plants were used for practice and then discarded. No special mechanical aid was used in the potting operation alone. Trainees competed successfully with sighted persons in this operation in special tests. Plants, seedlings, and cuttings were handled at the same stage of growth as for sighted persons.

It was impossible for blind trainees to determine fertilizer needs before it was too late to help the plant. When a sighted person determined the needs and recommendations for fertilizer, the actual application did not present any problem.

Trainees were slow in planting small seed, but attained satisfactory results. Mixing of soils, manures, peat moss and fertilizers was done by trainees with some vision. Completely blind individuals were not able to master this job, although most of them learned by feel of the soil whether it was of suitable texture and structure.

Spraying and fumigating in a definitely worked area, such as the greenhouse or outside bed, was accomplished by all trainees. However, the job proved difficult in broad areas, such as the nursery and campus. Preparation of sprays must be done by sighted persons because of the danger involved.

CHAPTER VII - CONCLUSIONS AND RECOMMENDATIONS

In this project, the greatest single problem was keeping the trainees oriented as to location of plants, equipment, benches, and other materials and facilities. A systematic arrangement is needed to avoid confusion. It is recommended that for orientation, some type of ground bed be used in growing outside plants.

As totally blind persons cannot detect small insects and fungus diseases before damage is done, it is recommended that a sighted person help in this phase. It is also recommended that emphasis be placed on general preventive spray and dusting program rather than detection and control of specific pests.

The year-round chrysanthemum production was the most successful complete crop program. Other crops and phases of production that were handled easily by the trainees were production of foliage plants, propagation by cuttage, greenhouse production of tomatoes, production of miscellaneous bedding plants and forcing of bulbs, hydrangeas, poinsettias, geraniums, and Easter Lilies.

Some of the tasks most easily mastered:

Little difficulty was experienced in (1) mixing soils and fertilizers, (2) potting of all types of cuttings and plants, (3) watering

plants in pots and on benches, (4) identification of plants and parts, and (5) program fertilization.

Jobs in greenhouse and nursery training found to require some vision were: Application of mulch material to small plants, grading and sloping land, movement of nursery plants, fumigation and spraying of small trees, mixing of spray material, and detection and control of insects and diseases.

It is recommended that at least 20 square feet of growing space, under glass, per trainee, be provided for a program of this type. In addition, there should be at least 500 square feet of outside space for growing cut flowers and planting liners for nursery production.

In a program of this type, it is recommended that classes be kept small enough for individual instruction. No more than six persons should be trained in any class. It is also recommended that a horticulturist and assistant horticulturist be employed. The horticulturist should have a thorough knowledge of the modern principles, practices, methods, supplies and equipment of horticulture; the ability to organize and teach courses in horticulture; extensive knowledge of the methods of combatting plant diseases, insects and weeds; the ability to train others in the planting and care of lawns, flowers, orchards, and ornamental trees and shrubs; the ability to accurately estimate needs for personnel, supplies and equipment; and the tact and patience to maintain harmonious relationships between members of the class. In addition, he should be able to efficiently use soil-testing equipment, sun-light illumination meters, and to operate vehicles and necessary tools and equipment for proper operation of a greenhouse and nursery. This includes proper control of light intensity and "length of day", temperatures, humidity, and other factors as necessary for the production of greenhouse crops.

The horticulturist should have a degree from a recognized college or a double major in agricultural education. He also should have four years of full-time, paid employment in a professional capacity, at least one year of which was in a responsible supervisory position. He should be able to show satisfactory evidence of ability and aptitude to work with blind persons.

He should be capable of developing a program of study for horticultural training, adapted to visually-handicapped persons.

He should be able to supervise construction of lath houses, cold frames, plant beds, irrigation systems, and other simple horticultural structures.

He should have the knowledge to schedule and maintain records of classes for adult trainees and to measure progress of the individual student. He should be able to plan experiments to determine effectiveness of different methods of instruction and per-

formance of tasks. He should be inventively inclined to devise ways and means by which blind persons may achieve the same objectives and proficiency as sighted persons and be able to select and devise new tools and instruct trainees in use of them.

He should be able to record and evaluate all training procedures, special tools and equipment developed, problems and solutions of practical problems, and formulate these into a training manual for use by other institutions wishing to train blind persons.

The assistant horticulturist should be able to assist in the instruction of students in the less technical phases of horticulture. His duties are performed under the professional supervision of the horticulturist.

Some examples of the assistant's duties are to instruct groups of six to eight trainees in general greenhouse and nursery work; to demonstrate the use of the tools and equipment; to describe the characteristics of various plants as to environmental needs, proper fertilization, time and age for transplanting, and methods of identification; and to assist in such duties as planting, transplanting of shrubbery, the preparation of seed beds, and simple propagation of trees, shrubs and plants. He should have a knowledge of the tools, equipment, and material used in horticulture, and of the characteristics of common flowers and shrubs and their care and use. He should have the ability to instruct small groups in less technical phases of flower and shrubbery culture, and to hold the interest, cooperation and confidence of students. The assistant horticulturist should be a graduate of an accredited senior high school and preferably two years of college. He should also have five years' experience in nursery, greenhouse, or related work.

He should take an active part in the operation of the greenhouse so that in the absence of the horticulturist, routine practices will continue as usual. In this type of project, it is imperative that all personnel be neat, honest, dependable, and have some leadership ability.

A greenhouse attendant should be employed to help in the labor of preparing materials for classes. A part-time ($\frac{1}{2}$) Secretary also should be employed.

The minimum equipment needed for a group of 10-12 trainees in a program of this type would be a well-equipped greenhouse of 2,500 square feet and at least a half acre of outside beds and slathouse space. The greenhouse should be equipped with air cooling, misting system for propagation, lighting and shading equipment, soil sterilizer, heating cables for propagation bench, adequate heating system, storage refrigerator and pots and plants for instructional purpose.

In addition, soil testing equipment, a light meter, filing cabinets, reference library, spraying and fumigation equipment, water

hose, labels, sprays and fumigants, plant trays, soil shredder and tables for demonstration and instruction in various operations should be provided.

It is recommended that women be trained in horticultural work provided they can be taught in separate classes. A special program should be developed because of the different type of work usually required of women in commercial establishments.

It is recommended that totally blind persons be placed in greenhouse jobs rather than nuresry jobs because of the orientation problem. Partially-sighted persons are capable of filling nursery jobs satisfactorily.

It is recommended that emphasis be placed on training for a few specific jobs. It has been found that specialists in limited fields compete better with sighted persons.

Visually-handicapped persons are generally slower in nursery and greenhouse tasks than sighted persons, but the handicap can be largely overcome with interest, patience, and a desire to work successfully with plants.

Orientation and adjustment as a preliminary to greenhouse training should not be the concern of the greenhouse staff. Until such services are made available, however, it remains the province of the staff to keep this in mind as they endeavor to understand the individual and his problems while in training.

VIII - SUMMARY

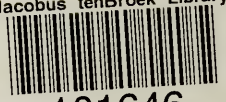
In September 1955, a cooperative project between the U. S. Department of Health, Education and Welfare, and the Vocational Rehabilitation Division of the Georgia State Department of Education was authorized as a pioneer project in the training of visually-handicapped persons in horticultural work. The site of the project was the Georgia Academy for the Blind in Macon, Georgia.

Funds were provided jointly for a trained staff, supervisory personnel, labor, greenhouse, equipment, and other facilities. Trainees were selected on recommendation of the Vocational Rehabilitation Division. Prospective trainees were screened by Counselors for interest and aptitude. Further screening was done by the training staff during the first 30 days of the program. A separate program of study for high school students was organized as part of the regular high school vocational program. General procedures for trainees were set up and followed. Special equipment and tools were devised or adapted. Specific training procedures were set up for each task in greenhouse work. Methods of determining progress of trainees were studied by the staff and trainees' progress was continuously analyzed.

During the four year of the project, forty-five trainees enrolled in the course. The results of the program have been good with almost all trainees receiving some benefit from the training. For evaluation of the project, the program was divided into three general phases. Phase one was a 30-day orientation and trial period; phase two was a three months general training period; and phase three consisted of eight months of specific instruction on various crops. Industry advisors were used in evaluating and improving the project.

It is emphasized that aptitude, intelligence, and a desire to learn are more important than sight to achieve success in greenhouse and nursery work of the kinds stressed in this project.

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